

In the Claims

Applicants submit a new complete claim set showing marked up claims with insertions indicated by underlining and deletions indicated by strikeouts and/or double bracketing.

Please amend claims 1, 14, 34, 45, 62 and 72 as noted below.

91 1. (Currently amended) In a computer system including a host computer and at least one computer system resource accessible to the host computer, wherein the host computer comprises an operating system and the operating system uses at least one identifier to enable access by the host computer to the at least one computer system resource, the at least one identifier identifying the at least one computer system resource, a method of responding to changes in a configuration of the computer system impacting a manner in which the at least one computer system resource is accessed by the host computer, the method comprising steps of:

A) storing information relating to a first configuration of the computer system at a first point in time, the first configuration relating to a first manner of accessing the at least one computer system resource by the host computer, the first manner of accessing the at least one computer system resource including the use of a first identifier by the operating system to identify the at least one computer system resource;

(B) determining a second configuration of the computer system at a second point in time, the second configuration relating to a second manner of accessing the at least one computer system resource by the host computer;

(C) comparing the second configuration of the computer system with the first configuration to determine whether the second configuration differs from the first configuration in that the second manner of accessing the at least one computer system resource includes the use of a second identifier by the operating system to identify the at least one computer system resource, wherein the second identifier differs from the first identifier; and

(D) when it is determined in the step (C) that the second configuration differs from the first configuration, determining the second identifier used by the operating system in the second manner of accessing the at least one computer system resource by the host computer, wherein the act of determining comprises using at least one component of

information that uniquely identifies the at least one computer system resource in a manner that is independent of the second configuration.

2. (Original) The method of claim 1, wherein the step (B) includes a step of determining the second configuration of the computer system in response to a rebooting of the host computer.

3. (Original) The method of claim 1, wherein the step (B) includes a step of determining the second configuration of the computer system each time the host computer is rebooted.

4. (Original) The method of claim 1, wherein the at least one computer system resource includes a plurality of devices accessible by the host computer, and wherein the step (A) includes a step of storing the information relating to the first configuration in a form that includes at least one component of information that uniquely identifies each one of the plurality of devices accessible by the host computer using information independent of the first configuration of the computer system.

5. (Original) The method of claim 4, wherein the at least one computer system resource includes at least one storage system and the plurality of devices includes a plurality of logical volumes of data in the at least one storage system, and wherein the step (A) includes a step of storing, for each one of the logical volumes, an identifier that uniquely identifies the logical volume among the plurality of logical volumes in the at least one storage system.

6. (Original) The method of claim 5, wherein the at least one storage system includes a plurality of storage systems, and wherein the step (A) includes a step of storing, for each one of the plurality of logical volumes, an identifier that uniquely identifies a one of the plurality of storage systems in which the one of the plurality of logical volumes is stored.

7. (Original) The method of claim 1, wherein the at least one computer system resource includes a plurality of devices accessible by the host computer, and wherein the step (A) includes a step of storing the information relating to the first configuration in a form that includes first and

second identifiers for each one of the plurality of devices accessible by the host computer, the first identifier identifying the one of the plurality of devices using information relating to the first configuration of the computer system, the second identifier identifying the one of the plurality of devices using information independent of the first configuration of the computer system.

8. (Original) The method of claim 7, wherein the at least one computer system resource includes at least one storage system and the plurality of devices includes a plurality of logical volumes of data, and wherein the step (A) includes a step of storing the first and second identifiers for each of the plurality of logical volumes, and wherein the second identifier for each one of the logical volumes uniquely identifies the logical volume among the plurality of logical volumes in the at least one storage system.

9. (Original) The method of claim 7, wherein the first identifier includes information descriptive of a path through which the one of the plurality of logical volumes is accessible to the host computer.

10. (Original) The method of claim 7, wherein the step (A) includes a step of storing the information relating to the first configuration in a form that further includes a third identifier for each one of the plurality of devices accessible by the host computer, the third identifier being formed from a piece of information that is obtainable by accessing the one of the plurality of devices at the first point in time.

11. (Original) The method of claim 10, wherein the step (B) includes a step of, for at least one of the first identifiers, querying the at least one of the plurality of devices corresponding to the at least one of the first identifiers at the second point in time to obtain the piece of information available by accessing the at least one of the plurality of devices, and wherein the step (C) includes a step of comparing the piece of information obtained in the step (B) to the third identifier stored in the step (A) to determine whether the second configuration differs from the first configuration with respect to the at least one of the plurality of devices.

12. (Original) The method of claim 1, wherein the at least one computer system resource includes a plurality of devices accessible by the host computer, and wherein the step (A) includes a step of storing the information relating to the first configuration in a form that includes an identifier for each one of the plurality of devices accessible by the host computer, the identifier being formed from a piece of information that is obtainable by accessing the one of the plurality of devices at the first point in time.

91 13. (Original) The method of claim 12, wherein the step (B) includes a step of querying at least one of the plurality of devices at the second point in time to obtain the piece of information available by accessing the at least one of the plurality of devices, and wherein the step (C) includes a step of comparing the piece of information obtained in the step (B) to the identifier stored in the step (A) to determine whether the second configuration differs from the first configuration with respect to the at least one of the plurality of devices.

14. (Currently amended) In a computer system including a host computer and at least one computer system resource accessible to at least one application program executing on the host computer, wherein the host computer comprises an operating system and the operating system uses at least one identifier to enable access by the host computer to the at least one computer system resource, the at least one identifier identifying the at least one computer system resource, a method of reconfiguring the computer system, the method comprising a step of:

A) dynamically reconfiguring the computer system, without reinitializing the host computer or the application program, in response to a change in a configuration of the computer system that changes the at least one identifier used by the operating system to enable access by the host computer to the at least one computer system resource, to alter a manner in which the at least one application program accesses the at least one computer system resource.

15. (Original) The method of claim 14, further including steps of:

B) prior to the step (A), suspending input/output (I/O) operations from the application program directed to the at least one computer system resource; and

(C) subsequent to the step (A), resuming I/O operations from the application program directed to the at least one computer system resource.

16. (Original) The method of claim 14, wherein:

the at least one computer system resource includes a storage system including a plurality of storage devices accessible by the host computer;

the host computer includes an application layer owning a plurality of logical objects;

the computer system further includes a mapping entity that includes at least one mapping layer mapping the plurality of logical objects from the application layer to a physical layer relating to the plurality of storage devices; and

the step (A) includes a step of dynamically updating the at least one mapping layer to reflect a change in the configuration of the computer system without reinitializing the mapping entity.

17. (Original) The method of claim 16, further comprising a step of:

B) creating the mapping layer to include, for each one of the plurality of storage devices accessible by the host computer, a first component of information that uniquely identifies the one of the plurality of storage devices accessible by the host computer using information dependent upon a configuration of the storage system and a second component of information that uniquely identifies the one of the plurality of storage devices accessible by the host computer using information obtainable from the storage system.

18. (Original) The method of claim 14, wherein the at least one computer system resource includes a storage system storing at least one logical volume of data, the storage system having at least first and second ports through which the at least one logical volume of data can be made accessible to the at least one application program executing on the host computer; and

wherein the step (A) includes a step of dynamically reconfiguring the computer system from a first configuration to a second configuration, wherein in the first configuration the at least one logical volume is accessible to the at least one application

program executing on the host computer via the first port of the storage system, and wherein in the second configuration the at least one logical volume is accessible to the at least one application program executing on the host computer via the second port of the storage system.

19. (Original) The method of claim 16, wherein the step (A) includes a step of dynamically reconfiguring the computer system from a first configuration to a second configuration, wherein at least one physical connection between the host computer and the storage system differs between the first and second configurations.

20. (Original) The method of claim 14, wherein the at least one computer system resource includes a plurality of storage systems each storing a plurality of logical volumes of data, the plurality of storage systems including a first storage system and a second storage system; and wherein the step (A) includes a step of dynamically reconfiguring the computer system to move at least one of the plurality of logical volumes of data from the first storage system to the second storage system.

✓ Claims 21-33 (Canceled)

34. (Currently amended) A computer readable medium encoded with a program for execution on a host computer in a computer system including the host computer and at least one computer system resource accessible to the host computer, wherein the host computer comprises an operating system and the operating system uses at least one identifier to enable access by the host computer to the at least one computer system resource, the at least one identifier identifying the at least one computer system resource, the program, when executed on the host computer, performs a method of responding to changes in a configuration of the computer system impacting a manner in which the at least one computer system resource is accessed by the host computer, the method comprising steps of:

A) storing information relating to a first configuration of the computer system at a first point in time, the first configuration relating to a first manner of accessing the at

least one computer system resource by the host computer, the first manner of accessing the at least one computer system resource including the use of a first identifier by the operating system to identify the at least one computer system resource;

(B) determining a second configuration of the computer system at a second point in time, the second configuration relating to a second manner of accessing the at least one computer system resource by the host computer;

(C) comparing the second configuration of the computer system with the first configuration to determine whether the second configuration differs from the first configuration in that the second manner of accessing the at least one computer system resource includes the use of a second identifier by the operating system to identify the at least one computer system resource, wherein the second identifier differs from the first identifier; and

(D) when it is determined in the step (C) that the second configuration differs from the first configuration, determining the second identifier used by the operating system in the second manner of accessing the at least one computer system resource by the host computer, wherein the act of determining comprises using at least one component of information that uniquely identifies the at least one computer system resource in a manner that is independent of the second configuration.

35. (Original) The computer readable medium of claim 34, wherein the step (B) includes a step of determining the second configuration of the computer system in response to a rebooting of the host computer.

36. (Original) The computer readable medium of claim 34, wherein the step (B) includes a step of determining the second configuration of the computer system each time the host computer is rebooted.

37. (Original) The computer readable medium of claim 34, wherein the at least one computer system resource includes a plurality of devices accessible by the host computer, and wherein the step (A) includes a step of storing the information relating to the first configuration in a form that

includes at least one component of information that uniquely identifies each one of the plurality of devices accessible by the host computer using information independent of the first configuration of the computer system.

38. (Original) The computer readable medium of claim 34, wherein the at least one computer system resource includes a plurality of devices accessible by the host computer, and wherein the step (A) includes a step of storing the information relating to the first configuration in a form that includes first and second identifiers for each one of the plurality of devices accessible by the host computer, the first identifier identifying the one of the plurality of devices using information relating to the first configuration of the computer system, the second identifier identifying the one of the plurality of devices using information independent of the first configuration of the computer system.

39. (Original) The computer readable medium of claim 38, wherein the at least one computer system resource includes at least one storage system and the plurality of devices includes a plurality of logical volumes of data, and wherein the step (A) includes a step of storing the first and second identifiers for each of the plurality of logical volumes, and wherein the second identifier for each one of the logical volumes uniquely identifies the logical volume among the plurality of logical volumes in the at least one storage system.

40. (Original) The computer readable medium of claim 38, wherein the first identifier includes information descriptive of a path through which the one of the plurality of logical volumes is accessible to the host computer.

41. (Original) The computer readable medium of claim 38, wherein the step (A) includes a step of storing the information relating to the first configuration in a form that further includes a third identifier for each one of the plurality of devices accessible by the host computer, the third identifier being formed from a piece of information that is obtainable by accessing the one of the plurality of devices at the first point in time.

42. (Original) The computer readable medium of claim 41, wherein the step (B) includes a step of, for at least one of the first identifiers, querying the at least one of the plurality of devices corresponding to the at least one of the first identifiers at the second point in time to obtain the piece of information available by accessing the at least one of the plurality of devices, and wherein the step (C) includes a step of comparing the piece of information obtained in the step (B) to the third identifier stored in the step (A) to determine whether the second configuration differs from the first configuration with respect to the at least one of the plurality of devices.

43. (Original) The computer readable medium of claim 34, wherein the at least one computer system resource includes a plurality of devices accessible by the host computer, and wherein the step (A) includes a step of storing the information relating to the first configuration in a form that includes an identifier for each one of the plurality of devices accessible by the host computer, the identifier being formed from a piece of information that is obtainable by accessing the one of the plurality of devices at the first point in time.

44. (Original) The computer readable medium of claim 43, wherein the step (B) includes a step of querying at least one of the plurality of devices at the second point in time to obtain the piece of information available by accessing the at least one of the plurality of devices, and wherein the step (C) includes a step of comparing the piece of information obtained in the step (B) to the identifier stored in the step (A) to determine whether the second configuration differs from the first configuration with respect to the at least one of the plurality of devices.

45. (Currently amended) A computer readable medium encoded with a reconfiguration program for execution on a host computer in a computer system including the host computer and at least one computer system resource accessible to at least one application program executing on the host computer, wherein the host computer comprises an operating system and the operating system uses at least one identifier to enable access by the host computer to the at least one computer system resource, the at least one identifier identifying the at least one computer system resource, the reconfiguration program, when executed on the host computer, performs a method of reconfiguring the computer system, the method comprising a step of:

A) dynamically reconfiguring the computer system, without reinitializing the host computer or the application program, in response to a change in a configuration of the computer system that changes the at least one identifier used by the operating system to enable access by the host computer to the at least one computer system resource, to alter a manner in which the at least one application program accesses the at least one computer system resource.

46. (Original) The computer readable medium of claim 45, wherein:

the at least one computer system resource includes a storage system including a plurality of storage devices accessible by the host computer;

the host computer includes an application layer owning a plurality of logical objects;

the computer system further includes a mapping entity that includes at least one mapping layer mapping the plurality of logical objects from the application layer to a physical layer relating to the plurality of storage devices; and

the step (A) includes a step of dynamically updating the at least one mapping layer to reflect a change in the configuration of the computer system without reinitializing the mapping entity.

47. (Original) The computer readable medium of claim 46, further comprising a step of:

B) creating the mapping layer to include, for each one of the plurality of storage devices accessible by the host computer, a first component of information that uniquely identifies the one of the plurality of storage devices accessible by the host computer using information dependent upon a configuration of the storage system and a second component of information that uniquely identifies the one of the plurality of storage devices accessible by the host computer using information obtainable from the storage system.

48. (Original) The computer readable medium of claim 45, wherein the at least one computer system resource includes a storage system storing at least one logical volume of data, the storage system having at least first and second ports through which the at least one logical

volume of data can be made accessible to the at least one application program executing on the host computer; and

wherein the step (A) includes a step of dynamically reconfiguring the computer system from a first configuration to a second configuration, wherein in the first configuration the at least one logical volume is accessible to the at least one application program executing on the host computer via the first port of the storage system, and wherein in the second configuration the at least one logical volume is accessible to the at least one application program executing on the host computer via the second port of the storage system.

Al

49. (Original) The computer readable medium of claim 46, wherein the step (A) includes a step of dynamically reconfiguring the computer system from a first configuration to a second configuration, wherein at least one physical connection between the host computer and the storage system differs between the first and second configurations.

50. (Original) The computer readable medium of claim 45, wherein the at least one computer system resource includes a plurality of storage systems each storing a plurality of logical volumes of data, the plurality of storage systems including a first storage system and a second storage system; and

wherein the step (A) includes a step of dynamically reconfiguring the computer system to move at least one of the plurality of logical volumes of data from the first storage system to the second storage system.

Claims 51-61 (Canceled)

62. (Currently amended) A host computer for use in a computer system including the host computer and at least one computer system resource accessible to the host computer, the host computer comprising:

an operating system for enabling access to the at least one computer system resource, the operating system using at least one identifier to enable access by the host computer to

the at least one computer system resource, the at least one identifier identifying the at least one computer system resource;

storing means for storing information relating to a first configuration of the computer system at a first point in time, the first configuration relating to a first manner of accessing the at least one computer system resource by the host computer, the first manner of accessing the at least one computer system resource including the use of a first identifier by the operating system to identify the at least one computer system resource;

first determining means for determining a second configuration of the computer system at a second point in time, the second configuration relating to a second manner of accessing the at least one computer system resource by the host computer;

comparing means for comparing the second configuration of the computer system with the first configuration to determine whether the second configuration differs from the first configuration in that the second manner of accessing the at least one computer system resource includes the use of a second identifier by the operating system to identify the at least one computer system resource, wherein the second identifier differs from the first identifier; and

second determining means for determining the second identifier used by the operating system in the second manner of accessing the at least one computer system resource by the host computer when it is determined by the first determining means that the second configuration differs from the first configuration, wherein the act of determining comprises using at least one component of information that uniquely identifies the at least one computer system resource in a manner that is independent of the second configuration.

63. (Original) The host computer of claim 62, wherein the first determining means includes means for determining the second configuration of the computer system in response to a rebooting of the host computer.

64. (Original) The host computer of claim 62, wherein the at least one computer system resource includes a plurality of devices accessible by the host computer, and wherein the storing

means includes means for storing the information relating to the first configuration in a form that includes at least one component of information that uniquely identifies each one of the plurality of devices accessible by the host computer using information independent of the first configuration of the computer system.

65. (Original) The host computer of claim 62, wherein the at least one computer system resource includes a plurality of devices accessible by the host computer, and wherein the storing means includes means for storing the information relating to the first configuration in a form that includes first and second identifiers for each one of the plurality of devices accessible by the host computer, the first identifier identifying the one of the plurality of devices using information relating to the first configuration of the computer system, the second identifier identifying the one of the plurality of devices using information independent of the first configuration of the computer system.

66. (Original) The host computer of claim 65, wherein the at least one computer system resource includes at least one storage system and the plurality of devices includes a plurality of logical volumes of data, and wherein the storing means includes means for storing the first and second identifiers for each of the plurality of logical volumes, and wherein the second identifier for each one of the logical volumes uniquely identifies the logical volume among the plurality of logical volumes in the at least one storage system.

67. (Original) The host computer of claim 65, wherein the first identifier includes information descriptive of a path through which the one of the plurality of logical volumes is accessible to the host computer.

68. (Original) The host computer of claim 65, wherein the storing means includes means for storing the information relating to the first configuration in a form that further includes a third identifier for each one of the plurality of devices accessible by the host computer, the third identifier being formed from a piece of information that is obtainable by accessing the one of the plurality of devices at the first point in time.

69. (Original) The host computer of claim 68, wherein the first determining means includes means for querying the at least one of the plurality of devices corresponding to at least one of the first identifiers at the second point in time to obtain the piece of information available by accessing the at least one of the plurality of devices, and wherein the comparing means includes means for comparing the piece of information obtained by the first determining means to the third identifier stored by the storing means to determine whether the second configuration differs from the first configuration with respect to the at least one of the plurality of devices.

70. (Original) The host computer of claim 62, wherein the at least one computer system resource includes a plurality of devices accessible by the host computer, and wherein the storing means includes means for storing the information relating to the first configuration in a form that includes an identifier for each one of the plurality of devices accessible by the host computer, the identifier being formed from a piece of information that is obtainable by accessing the one of the plurality of devices at the first point in time.

71. (Original) The host computer of claim 70, wherein the first determining means includes means for querying at least one of the plurality of devices at the second point in time to obtain the piece of information available by accessing the at least one of the plurality of devices, and wherein comparing means includes means for comparing the piece of information obtained by the first determining means to the identifier stored by the storing means to determine whether the second configuration differs from the first configuration with respect to the at least one of the plurality of devices.

72. (Currently amended) A host computer for use in a computer system including the host computer and at least one computer system resource accessible to at least one application program executing on the host computer, the host computer comprising:

an operating system and the operating system uses at least one identifier to enable access by the host computer to the at least one computer system resource, the at least one identifier identifying the at least one computer system resource; and

at least one controller to dynamically reconfigure the computer system, without reinitializing the host computer or the application program, in response to a change in a configuration of the computer system that changes the at least one identifier used by the operating system to enable access by the host computer to the at least one computer system resource, to alter a manner in which the at least one application program accesses the at least one computer system resource.

73. (Original) The host computer of claim 72, wherein:

the at least one computer system resource includes a storage system including a plurality of storage devices accessible by the host computer;

the host computer includes an application layer owning a plurality of logical objects and a mapping entity that includes at least one mapping layer mapping the plurality of logical objects from the application layer to a physical layer relating to the plurality of storage devices; and

the at least one controller is further configured to dynamically update the at least one mapping layer to reflect a change in the configuration of the computer system without reinitializing the mapping entity.

74. (Original) The host computer of claim 73, wherein the at least one controller is further configured to:

create the mapping layer to include, for each one of the plurality of storage devices accessible by the host computer, a first component of information that uniquely identifies the one of the plurality of storage devices accessible by the host computer using information dependent upon a configuration of the storage system and a second component of information that uniquely identifies the one of the plurality of storage devices accessible by the host computer using information obtainable from the storage system.

75. (Original) The host computer of claim 72, wherein the at least one computer system resource includes a storage system storing at least one logical volume of data, the storage system

having at least first and second ports through which the at least one logical volume of data can be made accessible to the at least one application program executing on the host computer; and wherein the at least one controller is further configured to dynamically reconfigure the computer system from a first configuration to a second configuration, wherein in the first configuration the at least one logical volume is accessible to the at least one application program executing on the host computer via the first port of the storage system, and wherein in the second configuration the at least one logical volume is accessible to the at least one application program executing on the host computer via the second port of the storage system.

76. (Original) The host computer of claim 73, wherein the at least one controller is configured to:

dynamically reconfigure the computer system from a first configuration to a second configuration, wherein at least one physical connection between the host computer and the storage system differs between the first and second configurations.

77. (Original) The host computer of claim 72, wherein the at least one computer system resource includes a plurality of storage systems each storing a plurality of logical volumes of data, the plurality of storage systems including a first storage system and a second storage system; and

wherein the at least one controller is configured to dynamically reconfigure the computer system to move at least one of the plurality of logical volumes of data from the first storage system to the second storage system.

✓ Claims 78-85 (Canceled)